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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 : C12N 15/82, 9/00, 15/11, 7/00, C12Q 1/68, A01H 5/00

A2

(11) International Publication Number: **WO 00/28057**

(43) International Publication Date: 18 May 2000 (18.05.00)

(21) International Application Number: PCT/US99/26478

(22) International Filing Date: 9 November 1999 (09.11.99)

(30) Priority Data:
60/107,789 10 November 1998 (10.11.98) US

(71) Applicants *(for all designated States except US)*: E.I. DU PONT DE NEMOURS AND COMPANY [US/US]; 1007 Market Street, Wilmington, DE 19898 (US). PIONEER HI-BRED INTERNATIONAL, INC. [US/US]; 7100 N.W. 62nd Avenue, Johnston, IA 50131 (US).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: FAMODU, Omolayo, O. [US/US]; 216 Barrett Run Place, Newark, DE 19702 (US). SIMMONS, Carl [US/US]; 4228 Holland Drive, Des Moines, IA 50310 (US).

(74) Agent: FEULNER, Gregory, J.; E.I. du Pont de Nemours and Company, Legal Patent Center, 1007 Market Street, Wilmington, DE 19898 (US).

(81) Designated States: AE, AL, AU, BA, BB, BG, BR, CA, CN, CR, CU, CZ, DM, EE, GD, GE, HR, HU, ID, IL, IN, IS, JP, KP, KR, LC, LK, LR, LT, LV, MG, MK, MN, MX, NO, NZ, PL, RO, SG, SI, SK, SL, TR, TT, UA, US, UZ, VN, YU, ZA, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).

Published
Without international search report and to be republished upon receipt of that report.

(54) Title: PLANT AMINOACYL–tRNA SYNTHETASES

(57) Abstract

This invention relates to an isolated nucleic acid fragment encoding an aminoacyl–tRNA synthetase. The invention also relates to the construction of a chimeric gene encoding all or a portion of the aminoacyl–tRNA synthetase, in sense or antisense orientation, wherein expression of the chimeric gene results in production of altered levels of the aminoacyl–tRNA synthetase in a transformed host cell.

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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification [7]: C12N 15/82, 9/00, 15/11, 7/00, C12Q 1/68, A01H 5/00 — A3

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(75) Inventors/Applicants (*for US only*): FAMODU, Omolayo, O. [US/US]; 216 Barrett Run Place, Newark, DE 19702 (US). SIMMONS, Carl [US/US]; 4228 Holland Drive, Des Moines, IA 50310 (US).

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23 November 2000 (23.11.00)

(54) Title: PLANT AMINOACYL-tRNA SYNTHETASES

(57) Abstract

This invention relates to an isolated nucleic acid fragment encoding an aminoacyl-tRNA synthetase. The invention also relates to the construction of a chimeric gene encoding all or a portion of the aminoacyl-tRNA synthetase, in sense or antisense orientation, wherein expression of the chimeric gene results in production of altered levels of the aminoacyl-tRNA synthetase in a transformed host cell.

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EE	Estonia						

INTERNATIONAL SEARCH REPORT

Inter onal Application No
PCT/US 99/26478

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 C12N15/82 C12N9/00 C12N15/11 C12N7/00 C12Q1/68
A01H5/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 C12N C12Q A01H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

BIOSIS, CHEM ABS Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	SASAKI, T.: DATABASE DBEST ID:36698, 2 December 1993 (1993-12-02), XP002136610 the whole document & EMBL ACCESSION NO:D23310, 28 November 1993 (1993-11-28).	1,3,5-8, 10,44, 45,47, 51-53
X	SASAKI, T.: DATABASE DBEST ID:23829, 17 May 1993 (1993-05-17), XP002136611 the whole document & EMBL ACCESSION NO:D16052, 19 May 1993 (1993-05-19).	1,3,5-8, 10,44, 45,47, 51-53

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[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

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Date of the actual completion of the international search	Date of mailing of the international search report
2 August 2000	16.08.00

Name and mailing address of the ISA	Authorized officer
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Form PCT/ISA/210 (second sheet) (July 1992)

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication where appropriate, of the relevant passages	Relevant to claim No.
X	ANDERSEN, R.V.: "H.vulgare mRNA for L-Glutamate:tRNA-Glu ligase" EMBL ACCESSION NO: X83523, 21 December 1994 (1994-12-21), XP002136617 the whole document & SWISSPROT ACCESSION NO:Q43768, 1 November 1997 (1997-11-01).	11, 13-18, 20,44, 45,47, 50-53
X	SASAKI, T: DATABASE DBEST ID:1195296, 6 August 1997 (1997-08-06), XP002144135 the whole document & SASAKI, T., ET AL.: "Rice cDNA, partial sequence (C50983_2A)." EMBL ACCESSION NO:C27100, 6 August 1997 (1997-08-06),	11, 13-18, 20,44, 45,47, 50-53
X	ANDERSEN, R.V., ET AL.: "N.tabacum mRNA for L-Glutamate:tRNA-Glu ligase" EMBL ACCESSION NO:X83524, 21 December 1994 (1994-12-21), XP002136618 the whole document & SWISSPROT ACCESSION NO:Q43794, 1 November 1997 (1997-11-01),	11, 13-18, 20,44, 45,47, 50,53
X	RACHER K I ET AL: "EXPRESSION AND CHARACTERIZATION OF A RECOMBINANT YEAST ISOLEUCYL-TRANSFER RNA SYNTHETASE" JOURNAL OF BIOLOGICAL CHEMISTRY 1991, vol. 266, no. 26, 1991, pages 17158-17164, XP002136612 ISSN: 0021-9258 the whole document	46
X	EP 0 835 936 A (SMITHKLINE BEECHAM PLC :SMITHKLINE BEECHAM CORP (US)) 15 April 1998 (1998-04-15) the whole document	46
P,X	WALBOT, V., ET AL.: "605010D08.y1 605 - Endosperm cDNA library from Schmidt lab Zea mays cDNA, mRNA sequence." EMBL ACCESSION NO:AI795505, 4 July 1999 (1999-07-04), XP002136613 the whole document	1,3,52

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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
P,X	WALBOT, V.: "605028D01.x1 605 - Endosperm cDNA library from Schmidt lab Zea mays cDNA, mRNA sequence." EMBL ACCESSION NO:AI667809. 17 May 1999 (1999-05-17), XP002144136 the whole document	11, 13-18, 20,44, 45,47, 50-53
P,X	WING, R.A., ET AL.: "nbxb0083M08f CUGI Rice BAC Library Oryza sativa genomic clone nbxb0083M08f, genomic survey sequence." EMBL ACCESSION NO:AQ574177. 3 June 1999 (1999-06-03), XP002144137 the whole document	52
P,X	SHOEMAKER, R., ET AL.: "sb97d10.y1 Gm-c1012 Glycine max cDNA clone GENOME SYSTEMS CLONE ID:Gm-c1012-620 5' similar to SW:SYE_TOBAC Q43794 GLUTAMYL-TRNA SYNTHETASE :,mRNA sequence." EMBL ACCESSION NO:AI899999. 28 July 1999 (1999-07-28), XP002144138 the whole document	11, 13-18, 20,44, 45,47, 50-53
A	SMALL, I.D.: "Arabidopsis thaliana gene encoding arginyl-tRNA synthetase, clone G7" EMBL ACCESSION NO:Z98760, 18 November 1997 (1997-11-18), XP002136614 the whole document & TREMBL ACCESSION NO:O23247, 1 January 1998 (1998-01-01),	1-10
A	SMALL, I.D.: "Arabidopsis thaliana gene encoding arginyl-tRNA synthetase, clone G6" EMBL ACCESSION NO:Z98759, 18 November 1997 (1997-11-18), XP002136615 the whole document & TREMBL ACCESSION NO:O23246, 1 January 1998 (1998-01-01),	1-10

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INTERNATIONAL SEARCH REPORT

Inter[illegible]al Application No
PCT/US 99/26478

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	DATABASE CHEMABS 'Online! CHEMICAL ABSTRACTS SERVICE, COLUMBUS, OHIO, US; JOACHIMIAK, A. ET AL: "Heparin - Sepharose column chromatography as a new method for the purification of aminoacyl- tRNA synthetases" retrieved from STN Database accession no. 94:134720 CA XP002136622 abstract & J. CHROMATOGR. (1981), 206(3), 600-5 , 1981.	10,46
A	DATABASE BIOSIS 'Online! BIOSCIENCES INFORMATION SERVICE, PHILADELPHIA, PA, US; 1981 JOACHIMIAK A ET AL: "METHOD FOR ISOLATION OF AMINOACYL TRANSFER RNA SYNTHETASES EC-6.1.1.- FROM PLANTS PURIFICATION AND SOME PROPERTIES OF METHIONYL PHENYL ALANYL AND ARGINYL TRANSFER RNA SYNTHETASES FROM YELLOW LUPINE LUPINUS-LUTEUS SEEDS" Database accession no. PREV198172059433 XP002136623 abstract & INTERNATIONAL JOURNAL OF BIOLOGICAL MACROMOLECULES 1981, vol. 3, no. 2, 1981, pages 121-128, ISSN: 0141-8130	10
A	DAY, I.S., ET AL.: "Arabidopsis thaliana glutamyl-tRNA synthetase mRNA, complete cds." EMBL ACCESSION NO:AF067773, 21 August 1998 (1998-08-21), XP002136616 the whole document & BIOCHIM. BIOPHYS. ACTA 1399(2-3):219-224(1998)., 20 August 1998 (1998-08-20), & TREMBL ACCESSION NO:082462, 1 November 1998 (1998-11-01).	11-20
A	WO 97 38718 A (SMITHKLINE BEECHAM PLC ;LAWLOR ELIZABETH JANE (US); SMITHKLINE BEE) 23 October 1997 (1997-10-23) the whole document	11-20, 41-46, 48,51-57
A	EP 0 785 261 A (SMITHKLINE BEECHAM PLC) 23 July 1997 (1997-07-23) the whole document	11-20, 41-46, 48,51-57

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INTERNATIONAL SEARCH REPORT

Inter onal Application No
PCT/US 99/26478

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication where appropriate, of the relevant passages	Relevant to claim No
A	AKASHI, K., ET AL.: "O.sativa mRNA histidyl tRNA synthetase" EMBL ACCESSION NO:Z85984, 13 February 1997 (1997-02-13). XP002136619 -& A CDNA CLONE ENCODING RICE HISTIDYL-TRNA SYNTHETASE (ACCESSION NO. Z85984)(PGR97-062)PLANT PHYSIOL. 113:1464-1464(1997).. XP002136620 ---	
A	AKASHI, K., ET AL.: "Potential dual targeting of an Arabidopsis archaebacterial-like histidyl-tRNA synthetase to mitochondria and chloroplasts" FEBS LETTERS, vol. 431, no. 1, 10 July 1998 (1998-07-10), pages 39-44. XP002136621 & AKASHI, K., ET AL.: "Arabidopsis thaliana histidyl-tRNA synthetase mRNA, complete cds." EMBL ACCESSION NO:AF020715, 28 September 1998 (1998-09-28), -----	

INTERNATIONAL SEARCH REPORT

national application No
PCT/US 99/26478

Box I Observations where certain claims were found unsearchable (Continuation of item 1 of first sheet)

This International Search Report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

1. [ ] Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

2. [ ] Claims Nos.:
because they relate to parts of the International Application that do not comply with the prescribed requirements to such an extent that no meaningful International Search can be carried out, specifically:

3. [ ] Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a).

Box II Observations where unity of invention is lacking (Continuation of item 2 of first sheet)

This International Searching Authority found multiple inventions in this international application, as follows:

see additional sheet

1. [ ] As all required additional search fees were timely paid by the applicant, this International Search Report covers all searchable claims.

2. [ ] As all searchable claims could be searched without effort justifying an additional fee, this Authority did not invite payment of any additional fee.

3. [X] As only some of the required additional search fees were timely paid by the applicant, this International Search Report covers only those claims for which fees were paid, specifically claims Nos.:

11-30,48,49 all completely, and 1-10,41-47,51-57 all partially representing groups 1,5,6,7,and 8

4. [ ] No required additional search fees were timely paid by the applicant. Consequently, this International Search Report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

[ ] The additional search fees were accompanied by the applicant's protest.

[X] No protest accompanied the payment of additional search fees.

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

This International Searching Authority found multiple (groups of) inventions in this international application, as follows:

1. Claims: 1-10,41-47,51-57 all partially

Polynucleotide sequence encoding corn arginyl-tRNA synthetase as represented by SEQ ID NOS:1 and 2 or encoding sequences with at least 80% identity to SEQ ID NO:2,polypeptides with at least 80% identity to SEQ ID NO:2,expression cassettes,host cells and positive selection methods based on said sequences,methods for selecting and obtaining aminoacyl-tRNA synthetases and evaluating compounds for the ability to inhibit aminoacyl-tRNA synthetases based on said sequences and also SEQ ID NOS:23 and 24,polynucleotides comprising at least 30 consecutive nucleotides of SEQ ID NOS:1 or 23

2. Claims: 1-10,41-47,51-57 all partially

Polynucleotide sequence encoding rice arginyl-tRNA synthetase as represented by SEQ ID NOS:3 and 4 or encoding sequences with at least 80% identity to SEQ ID NO:4,polypeptides with at least 80% identity to SEQ ID NO:4,expression cassettes,host cells and positive selection methods based on said sequences,methods for selecting and obtaining aminoacyl-tRNA synthetases and evaluating compounds for the ability to inhibit aminoacyl-tRNA synthetases based on said sequences and also SEQ ID NOS:25 and 26,polynucleotides comprising at least 30 consecutive nucleotides of SEQ ID NOS:3 or 25

3. Claims: 1-10,41-47,51-57 all partially

Polynucleotide sequence encoding soybean arginyl-tRNA synthetase as represented by SEQ ID NOS:5 and 6 or encoding sequences with at least 80% identity to SEQ ID NO:6,polypeptides with at least 80% identity to SEQ ID NO:6,expression cassettes,host cells and positive selection methods based on said sequences,methods for selecting and obtaining aminoacyl-tRNA synthetases and evaluating compounds for the ability to inhibit aminoacyl-tRNA synthetases based on said sequences and also SEQ ID NOS:27 and 28,polynucleotides comprising at least 30 consecutive nucleotides of SEQ ID NOS:5 or 27

4. Claims: 1-10,41-47,51-57 all partially

Polynucleotide sequence encoding wheat arginyl-tRNA synthetase as represented by SEQ ID NOS:7 and 8 or encoding sequences with at least 80% identity to SEQ ID NO:8,polypeptides with at least 80% identity to SEQ ID NO:8,expression cassettes,host cells and positive selection

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

methods based on said sequences,methods for selecting and obtaining aminoacyl-tRNA synthetases and evaluating compounds for the ability to inhibit aminoacyl-tRNA synthetases based on said sequences and also SEQ ID NOS:29 and 30,polynucleotides comprising at least 30 consecutive nucleotides of SEQ ID NOS:7 or 29

5. Claims: 11-20,41-46,48,51-57 all partially

Polynucleotide sequence encoding corn glutamyl-tRNA synthetase as represented by SEQ ID NOS:9 and 10 or encoding sequences with at least 90% identity to SEQ ID NO:10,polypeptides with at least 90% identity to SEQ ID NO:10,expression cassettes,host cells and positive selection methods based on said sequences,methods for selecting and obtaining aminoacyl-tRNA synthetases and evaluating compounds for the ability to inhibit aminoacyl-tRNA synthetases based on said sequences,polynucleotides comprising at least 30 consecutive nucleotides of SEQ ID NOS:9

6. Claims: 11-20,41-46,48,51-57 all partially

Polynucleotide sequence encoding rice glutamyl-tRNA synthetase as represented by SEQ ID NOS:11 and 12 or encoding sequences with at least 90% identity to SEQ ID NO:12,polypeptides with at least 90% identity to SEQ ID NO:12,expression cassettes,host cells and positive selection methods based on said sequences,methods for selecting and obtaining aminoacyl-tRNA synthetases and evaluating compounds for the ability to inhibit aminoacyl-tRNA synthetases based on said sequences and also SEQ ID NOS:31 and 32,polynucleotides comprising at least 30 consecutive nucleotides of SEQ ID NOS:11 and 31

7. Claims: 11-20,41-46,48,51-57 all partially

Polynucleotide sequence encoding soybean glutamyl-tRNA synthetase as represented by SEQ ID NOS:13 and 14 or encoding sequences with at least 90% identity to SEQ ID NO:14,polypeptides with at least 90% identity to SEQ ID NO:14,expression cassettes,host cells and positive selection methods based on said sequences,methods for selecting and obtaining aminoacyl-tRNA synthetases and evaluating compounds for the ability to inhibit aminoacyl-tRNA synthetases based on said sequences and also SEQ ID NOS:33 and 34,polynucleotides comprising at least 30 consecutive nucleotides of SEQ ID NOS:13 and 33

8. Claims: 21-30,49 all completely, and 41-46, 51-57 all partially

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

Polynucleotide sequence encoding wheat glutamyl-tRNA synthetase as represented by SEQ ID NOS:15 and 16 or encoding sequences with at least 80% identity to SEQ ID NO:16,polypeptides with at least 80% identity to SEQ ID NO:16,expression cassettes,host cells and positive selection methods based on said sequences,methods for selecting and obtaining aminoacyl-tRNA synthetases and evaluating compounds for the ability to inhibit aminoacyl-tRNA synthetases based on said sequences ,polynucleotides comprising at least 30 consecutive nucleotides of SEQ ID NO:15.

9. Claims: 31-46,50-57 all partially

Polynucleotide sequence encoding corn histidyl-tRNA synthetase as represented by SEQ ID NOS:17 and 18 or encoding sequences with at least 90% identity to SEQ ID NO:18,polypeptides with at least 90% identity to SEQ ID NO:18,expression cassettes,host cells and positive selection methods based on said sequences,methods for selecting and obtaining aminoacyl-tRNA synthetases and evaluating compounds for the ability to inhibit aminoacyl-tRNA synthetases based on said sequences ,polynucleotides comprising at least 30 consecutive nucleotides of SEQ ID NO:17.

10. Claims: 31-46,50-57 all partially

Polynucleotide sequence encoding soybean histidyl-tRNA synthetase as represented by SEQ ID NOS:19 and 20 or encoding sequences with at least 90% identity to SEQ ID NO:20,polypeptides with at least 90% identity to SEQ ID NO:20,expression cassettes,host cells and positive selection methods based on said sequences,methods for selecting and obtaining aminoacyl-tRNA synthetases and evaluating compounds for the ability to inhibit aminoacyl-tRNA synthetases based on said sequences and also SEQ ID NOS:35 and 36,polynucleotides comprising at least 30 consecutive nucleotides of SEQ ID NOS:19 and 35

11. Claims: 31-46,50-57 all partially

Polynucleotide sequence encoding wheat histidyl-tRNA synthetase as represented by SEQ ID NOS:21 and 22 or encoding sequences with at least 90% identity to SEQ ID NO:22,polypeptides with at least 90% identity to SEQ ID NO:22,expression cassettes,host cells and positive selection methods based on said sequences,methods for selecting and obtaining aminoacyl-tRNA synthetases and evaluating compounds for the ability to inhibit aminoacyl-tRNA

FURTHER INFORMATION CONTINUED FROM PCT/ISA/ 210

synthetases based on said sequences and also SEQ ID NOS:37 and 38.polynucleotides comprising at least 30 consecutive nucleotides of SEQ ID NOS:21 and 37

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No
PCT/US 99/26478

Patent document cited in search report		Publication date	Patent family member(s)		Publication date
EP 0835936	A	15-04-1998	JP 11098983	A	13-04-1999
WO 9738718	A	23-10-1997	EP 0904103	A	31-03-1999
EP 0785261	A	23-07-1997	WO 9726345	A	24-07-1997
			JP 11503331	T	26-03-1999